abnormally worn teeth. The squirrels of the *cepapi* group were also in an unsatisfactory state, the East-African forms being confused with *cepapi* proper, a slightly larger animal with even less hypsodont teeth; the tooth figured as belonging to *F. cepapi* in Dr. Major's paper belongs really to a squirrel from Kilimanjaro, probably *F. ganana*, which is closely allied to *F. Jacksoni*.

It is a curious and it might be said inconvenient fact, that in the pattern of their teeth and in the shape of the skull the harsher-furred squirrels approach *Sciurus*, while the softer-furred approach *Xerus*; with the exception of *S. rufobrachiatus*, the rule would almost hold good that the harsher the fur the nearer to *Sciurus*, the softer the fur the

nearer to Xerus.

III.—On the Butterflies of the Genera Leptophobia and Pieris. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

In spite of adverse criticism, I have seen no reason to change my decision either as to the distinctness of Leptophobia or as to what should be regarded as typical Pieris. Strictly speaking, perhaps, Parnassius apollo should be regarded as the type of Pieris, Schrank; Scudder, however, considers Ganoris rapæ to be the type, regarding the closely related G. brassicæ as generically distinct. I have clearly proved that the trivial characters upon which these two nearly allied "cabbage-butterflies" were separated are utterly unreliable, being inconstant in the extreme. If we were, on the other hand, to make Parnassius apollo the type of Pieris, it would not only create hopeless confusion, but would necessitate giving a fresh name to the subfamily Pierinæ, a course not to be desired by any who keep in view the sole object of nomenclature.

As before, therefore, I accept Boisduval's definition of *Pieris*, taking *P. amathonte* (= P. demophile \mathfrak{P}) as its type.

In the 'Biologia Centrali-Americana' the genus Pieris is expanded to include Synchloe, Mylothris, Leptophobia, and Glutophrissa; but personally I prefer to keep all groups having constant structural differences, whether of neuration or other details, as separate genera. As regards the statement that P. protodice (Synchloe) is sexually inconstant in neuration, I can only suggest that this state of things is individual and abnormal, inasmuch as nine out of our ten male examples show the apical furca in the primaries quite as

clearly as in our six females. This, I do not for a moment doubt, the authors of the 'Biologia' will frankly admit when they have again investigated the point.

The following is a list of the species so far as they are

known to me:-

LEPTOPHOBIA, Butler.

1. Leptophobia eleone.

Pieris eleone, Hewitson, in Gen. Diurn. Lep. pl. vi. fig. 6 (1847). Pieris Smithii, Kirby, Trans. Ent. Soc. 1881, p. 357; Rhop. Exot. i. pl. i. figs. 3, 4 (1888).

Venezuela, Bogota, Bolivia, Quito, Ecuador.

P. Smithii is evidently a slight variation, differing only in the narrowness of the posterior portion of the outer border of the primaries; the width of this border varies a good deal in L. eleone.

2. Leptophobia eleusis.

Pieris eleusis, Lucas, Rev. et Mag. de Zool. 1852, p. 331. Pieris suadella, Felder, Wien. ent. Monatschr. v. p. 79 (1861).

Venezuela. B. M.

I think it very doubtful whether the following is distinct from this.

3. Leptophobia helena.

Pieris helena, Lucas, Rev. et Mag. de Zool. 1852, p. 332.

Quito. B. M.

4. Leptophobia aripa.

Pieris aripa, Boisduval, Sp. Gén. Lép. i. p. 528 (1836). Pieris balidia, Boisduval, t. c. p. 529. Pieris elodia, Boisduval, l. c.

Rio Janeiro, Bolivia, Venezuela, Panama, Costa Rica, Guatemala, Mexico. B. M.

Our examples of L. balidia (from Rio Janeiro) have the under surface of the secondaries and apex of primaries more buff-coloured than Central-American examples; but the Bolivian example is somewhat intermediate.

5. Leptophobia pinara.

Pieris pinara, Felder, Reise der Nov., Lep. ii. p. 179 (1865). Bogota, Bolivia, and Ecuador. B. M.

6. Leptophobia erinna.

Pieris erinna, Hopffer, Stett. ent. Zeit. 1874, p. 335.

Peru. B. M.

7. Leptophobia nephthis.

Pieris nephthis, Hopffer, Stett. ent. Zeit. 1874, p. 334. Bolivia and Ecuador. Coll. Hewitson. Nearly allied to the preceding species.

8. Leptophobia stamnata.

Pieris stammata, Lucas, Rev. et Mag. de Zool. 1852, p. 330. Pieris euthemia, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

Venezuela. B. M.

9. Leptophobia penthica.

Leptalis? penthica, Kollar, Denkschr. Akad. Wiss. Wien, math.-nat. Cl. i. p. 360, pl. xlv. figs. 11, 12 (1850).

Bogota and Ecuador. B. M.

10. Leptophobia subargentea, sp. n.

3. Above very similar to the same sex of L. tenuicornis, but the base of primaries blacker, the white markings more cream-coloured, the large patch barely extending above the second median branch (so as to leave a much wider interval between it and the subapical bifid spot); secondaries much less blue, the inner bordering of the much larger creamy white patch being rather silver-grey. Primaries below with costa and fringe sulphur-yellow, apical area silver crossed by black veins; white area rather more extended basally than above and pure white, subapical white spot slightly broader: secondaries silver, with black veins; basal lobe daffodilyellow in front, saffron behind. Body normal.

Expanse of wings 58 millim.

Pucartambo, Peru (Whitely). Type B. M. Evidently related to, but distinct from, the following.

11. Leptophobia semicasia.

Pieris semicæsia, Felder, Reise der Nov., Lep. ii. p. 176 (1865).

Bogota.

This species seems to approach L. penthica, but with no white on upper surface of secondaries; the secondaries and apex of primaries below silvery rather than nacreous. The

description almost agrees with L. philoma, but Felder speaks of the subapical fasciole as tripartite.

12. Leptophobia olympia.

Pieris olympia, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

E. Peru (registered Nauta). B. M.

In the Hewitson collection a specimen, from Bolivia, stands under L. tovaria, from which species I think L. olympia very doubtfully distinct; it was described from a Venezuelan example.

13. Leptophobia tovaria.

Pieris tovaria, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

Q, Bogota. B. M.

14. Leptophobia subflavescens.

Pieris subflavescens, Kirby, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 362 (1887).

New Grenada.

Near to L. tovaria; almost the same on upper surface.

15. Leptophobia philoma.

Pieris philoma, Hewitson, Equat. Lep. p. 79 (1870).

Ecuador. Type coll. Hewitson.

Should this prove to be Felder's L. semicæsia it will have to sink; but it is possible that the species of Bogota may prove distinct.

16. Leptophobia cæsia.

Pieris cæsia, Lucas, Rev. et Mag. de Zool. 1852, p. 299; Hewitson, Exot. Butt. ii., Pier. pl. vi. figs. 43, 44 (1861).

Quito and Ecuador. Coll. Hewitson and B. M.

17. Leptophobia tenuicornis.

Leptophobia tenuicornis, Butler and Druce, Cist. Ent. i. p. 110 (1872); Lep. Exot. p. 116, pl. xliii. fig. 4 (1872).

Pieris tenuicornis, Godman and Salvin, Biol. Centr.-Am., Lep. Rhop.

vol. ii. p. 137, pl. lxii. figs. 8-11 (1889).

Colombia, Chiriqui, Costa Rica. B. M.

18. Leptophobia cinerea.

Pieris cinerca, Hewitson, Trans. Ent. Soc. ser. 3, vol. v. p. 563 (1867). Pieris menthe, Hopffer, Stett. ent. Zeit. 1874, p. 335.

Ecuador. Coll. Hewitson and B. M.

PIERIS, Boisduval.

This genus separates into several natural groups, the first being the *P. demophile* group, in which the females vaguely remind one of Ithomiinæ (such as Sais); the second is the *P. viardi* group, the females of which are often more like *Tithorea*, the under surface of the secondaries often richly coloured in both sexes; the third is represented by *P. philet i* (*P. monuste* auct. plur., nec Linn.) and its varieties, somewhat short-winged *Belenois*-like butterflies; the fourth and last is represented by the *P. buniæ* group, and unites characteristics of *Catopsilia* and *Ganoris*, all the males exhibiting well-developed patches and streaks of thickened scaling on the wings, but combined with the long slender autennæ and style of neuration of the later types of the Pierinæ.

Section 1.

1. Pieris demophile.

Q. Papilio demophile, Clerck, Icones, pl. xxviii. fig. 4 (1764). Papilio molphea, Cramer, Pap. Exot. ii. pl. cxvi. C (1779). S. Papilio amathonte, Cramer, l. c. A, B.

Pernambuco, St. Paulo, Tapajos. B. M.

2. Pieris calydonia.

Pieris calydonia, Boisduval, Sp. Gén. Lép. i. p. 439 (1836).

Venezuela, Panama, Nicaragua. B. M.

This species varies a good deal in the width of the blackbrown borders, our Venezuelan examples having considerably broader borders than those from Panama and Nicaragua.

3. Pieris leptalina.

Pieris leptalina, Bates, Journ. Entom. i. p. 236 (1861). Pieris pisonis, Hewitson, Exot. Butt. ii., Pier. pl. vi. figs. 40, 41.

E. Peru (registered "Nauta"). B. M.

4. Pieris kiçaha.

Pieris kiçaha, Reakirt, Proc. Ent. Soc. Phil. ii. p. 349 (1863). Pieris notistriga, Butler and Druce, Cist. Ent. i. p. 111 (1872).

Rio Dagua, Colombia. B. M.

5. Pieris marana.

Pieris marana, Doubleday, Ann. & Mag. Nat. Hist. vol. xiv. p. 421 (1844); Hewitson, Exot. Butt. ii., Pier. pl. vi. fig. 42 (1861).

West Indies?, Panama, Chimborazo. Type B. M. Ann. & Mag. N. Hist. Ser. 7. Vol. ii.

Doubleday's type was clearly collected either in the West Indies or on the coast of Central America (as evidenced by all the species from the same collection).

6. Pieris pandosia.

Pieris pandosia, Hewitson, Exot. Butt. i., Pier. pl. ii. fig. 14 (1853), ii., Pier. pl. vi. fig. 39 (1861).

Venezuela. B. M.

The type is in the Hewitson collection.

7. Pieris pylotis.

Pierrs pylotis, Godart, Enc. Méth. ix. p. 158 (1819).

Brazil. B. M.

The black spot on the primaries gives this species a somewhat aberrant aspect, but I think it is best located here.

Section 2.

8. Pieris viardi.

Q. Pieris viardi, Boisduval, Sp. Gén. Lép. i. p. 439 (1836). &. Pieris habra, Doubleday, Ann. & Mag. Nat. Hist. xvii. p. 22 (1846); Gen. Diurn. Lep. pl. vi. fig. 1 (1847).

3, Honduras (Doubleday's type). B. M.

In the Hewitson collection both sexes of this species stand together.

9. Pieris laogore.

Pieris laogore, Godman and Salvin, Biol. Centr.-Am., Rhop. ii. p. 134 (1889).

Mexico.

Differs from the preceding in the whole of the yellow markings in both sexes being replaced by orange.

10. Pieris tithoreides, sp. n.

3. Above much like P. locusta, but usually with one or two extra white spots in the border and with the narrow part of the border, at the posterior angle of the primaries, better defined: on the under surface the differences are better marked, the border of the primaries being produced inwards upon the first and second median branches as in P. locusta, but not so imperfectly, the greyish diffusion of that part of the border in P. locusta being filled in in the present species: in the secondaries the red, orange, and yellow markings are

all less vivid and there is a broad pale belt across the wing which includes the greater part of the discoidal cell, so that the lower ramus of the dark discoidal furca is clearly seen to be bordered on both sides with chrome-yellow; the submarginal yellow spots are rather more elongated than in *P. locusta*.

Expanse of wings 67 millim.

Q. Curiously resembles Tithorea Pavonii. Above black: the primaries with a broad sulphur-yellow patch, paler externally, commencing just above the base of the median vein and divided by this vein and its first branch, at the middle of which branch it terminates; below this a diffused yellow streak traversed by the submedian vein; a slightly irregular pearly white oblique macular band beyond the cell from costa nearly to outer margin, its inner edge angulated at subcostal vein, its last inferior spot small and well divided from the remaining divisions; two spots placed subapically, the upper one bifid; a larger spot near posterior angle: secondaries with brown costal area, below which is a broad sulphur-yellow belt, whitish at each extremity, from abdominal margin to second subcostal branch, above which are a few yellow scales; this belt is deeply incised upon the veins, but especially upon what would now be called the "upper" radial; a submarginal series of white spots. On the under surface the primaries are nearly as above, excepting that there is a pale patch at apex tinted with grey-brownish and yellow, and partly enclosing the bifid subapical spot; below this and near outer border are three bifid yellow spots, the last being the terminal spot of the postmedian stripe: the secondaries nearly resemble those of the male, but are altogether more vivid in colouring, the broad belt crossing the cell being mostly white and the streak bordering the discoidal <-shaped character (false vein) bright cadmium-yellow.

Expanse of wings 71 millim.

Male and female, Ecuador; two males and one female, Quito: coll. Hewitson. Two males, Chimborazo; female, Ecuador: B. M.

The types are in the Hewitson series.

11. Pieris mandela.

Pieris mandela, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

Venezuela. B. M.

Both sexes are in the Hewitson collection unlabelled with locality.

12. Pieris apicalis, sp. n.

3. Allied to *P. mandela*, but usually considerably larger, the apical border on the primaries with more oblique inner edge, its inferior continuation on outer border distinctly narrower, the upper subapical white spot larger; secondaries with the posterior half of the outer border decidedly broader: primaries below with the apical patch and border still more reduced, only one whiter submarginal spot (or at most two); secondaries with decidedly whiter, mostly white, irregular central belt.

Expanse of wings 70-79 millim.

Q. Not unlike the female of P. mandela, but much larger, the secondaries above with the whole base almost to the end of the cell suffused with greyish brown: the primaries on under surface not sulphur-tinted at base and the secondaries more pink in tint, the brown portions more coffee-coloured, the submarginal spots larger.

Expanse of wings 74 millim.

Two males, Quito and Upper Amazons: in coll. Hewitson.

Male, Bogota; female, E. Peru: B. M.

The type of the male is from Quito, that of the female from E. Peru (registered "Nauta")*. Hewitson referred one male of this species to P. mandela and the other to P. locusta, being guided solely by expanse of wings.

13. Pieris locusta.

Pieris locusta, Felder, Wien. ent. Monatschr. v. p. 81 (1861); Reise der Nov., Lep. ii. p. 175, pl. xxv. figs. 8, 9 (1865).

Two males, one female, Bogota. B. M.

The female is a good deal like *P. noctipennis*, the chief difference being that the secondaries show a greyish nebulous subcostal belt, barely visible until beyond the discoidal cell, and two sharply defined, apical, submarginal, creamy-white spots. Looking at the illustrations of both sexes in the 'Biologia Centrali-Americana,' I must admit that I greatly doubt the specific distinctness of the two forms.

14. Pieris noctipennis.

- Q. Pieris noctipennis, Butler and Druce, Cist. Ent. i. p. 111 (1872); Lep. Exot. p. 118, pl. xliii. fig. 7 (1872).
- Q, Nicaragua. In coll. Hewitson.

 The male is represented in the 'Biologia' with rather more
- * I have frequently called attention to the fact that the specimens thus registered are all believed to have been collected in E. Peru.

submarginal spots and a paler central belt across the under surface of the secondaries than exist in *P. locusta* from Bogota; the female also, from which the figure is taken, and that in the Hewitson collection both have the white area on the primaries somewhat yellower than in that sex of *P. locusta* or than in my type. I am afraid that none of these slight differences will prove to be even locally constant, but in the absence of positive proof I temporarily retain the two forms as possibly separate.

Section 3.

15. Pieris phileta.

Q. Pieris phileta, Fabricius, Syst. Ent. p. 471 (1775).

Mancipium monuste, Hübner, Samml. exot. Schmett. i. pl. cxxxiv. figs. 1-4.

Mylothris hippomonuste, Hübner, Verz. bek. Schmett. p. 91 (1816).

Pieris orseis, Godart, Enc. Méth. ix. p. 141 (1819).

Pieris virginia, Godart, l. c.

Pieris eubotea, Godart, t. c. p. 144 (1819).

Pieris feronia, Stephens, Ill. Brit. Ent., Haust. i. p. 149 (1828).

Pieris hemithea, Hübner, Samml. exot. Schmett., Zutr. figs. 693, 694 (1832).

Pièris cleomes, Boisduval and Leconte, Lép. Am. Sept. p. 43, pl. xvi. (1833).

Pieris evonima, Boisduval, Sp. Gén. Lép. i. p. 493 (1836).

Pieris vallei, Boisduval, t. c. p. 494 (1836). Pieris joppe, Boisduval, t. c. p. 495 (1836).

Pieris suasa, Boisduval, t. c. p. 549 (1836). Papilio albusta, Sepp, Surin. Vlind. iii. pl. cxli. (1855).

Pieris automate, Burmeister, Descr. Rep. Arg. v. p. 85, pl. iv. fig. 11 (1878).

Southern States of N. America, the West Indies, Central

America, and a great part of the Southern continent.

With so wide a range it is naturally extremely variable, a perfect series of gradations existing between typical *P. phileta* and the feebly bordered *P. automate*; these variations may be somewhat arbitrarily divided into seven grades, none of them apparently being confined to any particular region.

The species has hitherto stood in collections as P. monuste of Linnæus, with which some of the older authors were the first to confound it; but the description in the 'Museum Ludovicæ Ulricæ' cannot refer to this butterfly, inasmuch as, in the first place, no mention is made of the dentated character of the inner edge of the outer border of primaries, but, on the contrary, that of the secondaries is specially described as "denticulato-fuscus"; in the second place, no mention is made of the elongate subapical white spots on the primaries; and, lastly, the wings below are said to be concolorous, ex-

cepting that the borders show a greyish shade answering to those of the upper surface—"loco fusci coloris tantum cinerascentes ad marginem." The description is much more likely to be intended for *Udaina cynis*, only the under surface of the primaries in the latter species is almost too strongly coloured and the dentated character of the border still obtains on the upper surface. The type being lost, it is by far the best plan to let the name lapse unless something perfectly answering to the description can be found. Possibly *Mylothris phaola* or an allied form may be intended.

Section 4.

16. Pieris, sp. n.?

Four specimens of a species allied to *P. sevata*, but with more produced costa and more broadly bordered outer margin to primaries; the apex of primaries and the secondaries below sericeous pink.

Four males, Panama. B. M.

I have been unable to find a description of this species, which, however, I prefer to leave for the consideration of the authors of the 'Biologia Centrali-Americana.' It vaguely resembles Glutophrissa castalia, but differs in structure and in the colouring of the under surface; the primaries with much straighter outer margin, all the wings with streaks of thickened scales bordering the veins, and the anal segment with no trace of the dense prominent brush projecting from the base of the clasps (the presence of the brush in both sexes being the chief character upon which I founded the genus Glutophrissa), a feature wholly wanting in either sex of Pieris.

17. Pieris sevata.

Pieris sevata, Felder, Wien. ent. Monatschr. v. p. 81 (1861).

Male and female, Venezuela. B. M.

Bears a curious resemblance to some of the extreme types of P. pyranthe.

18. Pieris ausia.

Pieris ausia, Boisduval, Sp. Gén. Lép. i. p. 531 (1836).

One male, Mexico: B. M. Two females, without locality: coll. Hewitson.

There are four males in the Hewitson collection from Bolivia which must, I think, represent a variety of this

species; they are individually very inconstant in the width and character of the apical border of the primaries.

19. Pieris buniæ.

Catophaga buniæ, Hübner, Samml. exot. Schmett. ii. pl. cxxv. figs. 1, 2 (1816-36).

Pieris endeis, Godart, Enc. Méth. ix. p. 158 (1819).

Brazil, Rio Janeiro. B. M.

20. Pieris phaloe.

Pieris phaloe, Godart, Enc. Méth. ix. p. 156 (1819); Lucas, Lep. Exot. pl. xxvii. fig. 1 (1835).

Pará, Tapajos, Venezuela. B. M.

21. Pieris imperator.

Pieris imperator, Kirby, Trans. Ent. Soc. 1881, p. 357; Rhop. Exot. i. Pier. pl. i. figs. 1, 2 (1888).

One male, Ecuador: coll. Hewitson. Id. male and female var.?, Obydos (E. E. Austen): B. M.

22. Pieris diana.

Pieris diana, Felder, Wien. ent. Monatschr. v. p. 81 (1861).

Two males, New Granada: coll. Hewitson. One male, Brazil: B. M.

23. Pieris Van-Volxemii.

Pieris Van-Volxemii, Capronnier, Ann. Soc. Ent. Belg. xvii. p. 11, pl. i. fig. 1 (1874).

Buenos Ayres.

Probably intermediate between P. diana and P. amaryllis, but smaller than either.

24. Pieris amaryllis.

Papilio amaryllis, Fabricius, Ent. Syst. iii. 1, p. 189 (1797); Donovan, Ins. Ind. pl. xxviii. fig. 1 (1800).

Male and female, Jamaica. B. M.

25. Pieris Josepha.

Pieris Josepha, Godman and Salvin, Ann. & Mag. Nat. Hist. ser. 4, vol. ii. p. 150 (1868).

One male, Guatemala. B. M.

26. Pieris Josephina.

Pieris Josephina, Godart, Enc. Méth. ix. p. 158 (1819); Hübner, Samml. exot. Schmett. ii. pl. exxvi. (1819–36).

Male and female, St. Domingo, and male, Mexico. B. M. Mr. Heron and I have compared our specimens with Godart's types, now in the Edinburgh Museum.

IV.—Some new Coccide. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

Pulvinaria ephedræ, sp. n.

Mature female about 5 millim. long, with a snow-white

ovisac 11 millim. long and 4 broad.

Body of female quite soft, not at all chitinous, raspberrypink in front, greenish on dorsum, with some minute black specks. The front part of the female is covered by a thick square patch, 2 millim. broad, of white secretion; the hind margin is also fringed with secretion, and the body has irregular patches, arranged in three longitudinal bands, of which the middle is the narrowest and most definite. Ovisac firm, not adhering to objects which may chance to touch it, ribless.

Eggs greenish yellow.

 $\bar{\phi}$.—When boiled in caustic potash turns the liquid pink. Mounted on a slide, 6 millim. long and $4\frac{1}{2}$ broad; legs and antennæ brown. Antennæ 8-segmented, 1 at least twice as broad as long; formula 34251687. The several segments of an antenna were found to measure as follows in $\mu\mu$:—(1) 62, (2) 70, (3) 112, (4) 81, (5) 67, (6) 56, (7) 36, (8) 47. Legs ordinary, tarsus about half length of tibia; claw-digitules rather stout, extending beyond tip of claw; tarsal digitules slender. Margin with very numerous sharp spines, placed closer together than the length of one. Anal plates yellowish brown.

Hab. On Ephedra, Mesilla Park, New Mexico, a short distance east of the Agricultural College, in the Larrea zone.

May 1898.

A very beautiful and distinct species, superficially rather resembling *Icerya Rileyi*, which occurs in the same locality on *Larrea*. The characters italicized in the description are of subgeneric value, and *P. ephedræ* may be regarded as the type of a new subgenus—*Philephedra*.